OCCUPATIONAL NOISE EXPOSURE AMONG CONSTRUCTION WORKERS

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Dedicated to:

Lord Jesus Christ

and

Beloved Family Members

Dad, Mr. Dawi Nyaun

Mum, Mdm Lina Peros

Brother, Arron Samson Dawi

Thank You for your patience, love and support.

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ABSTRACT

Construction activities often generate noise complaints despite a short period of time framed over it takes place. One of the major contributions in noise is the construction equipments which tend to produce a high noise level. However, the noises from construction equipments do expose the workers who handle the task. Studies have shown most of the noise exposure do harm the safety and health of workers. This study focuses on (1) obtaining noise level among construction workers, (2) the compliance of permissible noise exposure level among workers; (3) assess the awareness and perceptions of noise exposure among workers and (4) explore the perceptions of noise impacts to safety and health workers. Occupational noise exposures for one hour among construction workers were assessed using noise dosimeters for on-site measurement and questionnaire surveys at the study construction site. The results for projection eight hours showed that almost all the activities exceeded the recommended noise level permitted by HSE whereas only one of the activities exceeded the FMR first schedule and OSHA permissible limit. For questionnaire surveys, the level awareness was encouraging yet a slight percentage revealed about the effects of noise in terms of age and work experience of respondents. Consequently, more approaches on the importance of noise exposure should be taken into consideration in order to improve awareness and mitigates the noise exposure.

ABSTRAK

Aktiviti pembinaan sering menjana aduan bunyi bising walaupun tempoh yang singkat dirangka lebih ia berlaku. Salah satu sumbangan besar dalam hingar adalah peralatan pembinaan yang cenderung menghasilkan tahap bunyi yang tinggi. Walau bagaimanapun, bunyi dari peralatan pembinaan terdedah kepada pekerja yang mengendalikan tugas itu. Kajian menunjukkan sebahagian besar daripada pendedahan bunyi membahayakan keselamatan dan kesihatan pekerja. Fokus kajian ini adalah untuk mendapatkan (1) tahap bunyi bising di kalangan pekerja binaan, (2) tahap pematuhan yang di benarkan kepada pendedahan bunyi bising di kalangan pekerja; (3) menilai kesedaran dan persepsi mengenai pendedahan bunyi bising di kalangan pekerja dan (4) meneroka persepsi terhadap impak bunyi kepada keselamatan dan kesihatan pekerja. Pendedahan bunyi bising pekerjaan selama satu jam di kalangan pekerja-pekerja binaan dinilai menggunakan dosimeter untuk pengukuran di tapak dan kajian soal selidik di tapak pembinaan kajian. Keputusan bagi unjuran lapan jam menunjukkan hampir semua aktiviti-aktiviti yang di nilai melebihi had yang disyorkan oleh HSE manakala hanya satu aktiviti melebihi jadual pertama FMR dan had yang dibenarkan oleh OSHA. Untuk borang kaji selidik, keputusan menunjukkan kesedaran di tahap yang menggalakkan namun terdapat sedikit peratusan mengenai impak bunyi bising kepada umur dan pengalaman pekerja. Oleh itu, pendekatan yang lebih terhadap kepentingan pendedahan bunyi yang perlu diambil kira dalam usaha untuk meningkatkan kesedaran dan pengurangan pendedahan bunyi.

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LIST OF ABBREVIATIONS

BS	British Standard
DOE	Department of Environment
EC	European Community Council Directive
EPA	Environmental Protection Agency
FMR	Factory and Machinery Regulation
GDP	Growth Domestic Products
HIRARC	Hazard Identification, Risk Assessment and Risk Control
HPD	Hearing Protection Device
HSE	Health and Safety Executive
NIHL	Noise Induced Hearing Loss
NIOSH	National Industry Occupational Safety and Health
NIP	Net Installed Power
OSHA	Occupational Safety and Health Administration
PTS	Permanent Threshold Shift
SLM	Sound Level Meter
SPSS	Statistic Packages for Social Sciences
TTS	Temporary Threshold Shift
TWA	Time Weighted Average

LIST OF SYMBOLS

dB	Decibel
dB(A)	‘A’ weighted decibel
Hz	Hertz
L_{10}	Statistical Centile Levels
L_{90}	Statistical Centile Levels
L_{eq}	Equivalent Sound Level
L_{max}	Maximum Instantaneous Level
Log	Logarithm

CHAPTER 1

INTRODUCTION

1.1 Introduction

Construction industry at present is the catalyst and progress to the national economy. In 2010, the construction sector contributed five per cent to the nation's growth domestic products (GDP) while in 2011, it insignificantly decreases to three and a half per cent with mainly construction projects driven by public projects under the government's development programme. On the other hand, based on the Economic Report 2011/2012 by Ministry of Finance Malaysia, one of the key drivers in economic growth in 2012 is the construction sector where it is expected to contribute up to seven per cent of GDP as large infrastructure projects and housing projects is in progression.

Nevertheless, the construction activities have the perspective to generate noise pollution that can impact both the surrounding people and community. With the construction may be short in period of time yet the Department of Environment, (DOE) Malaysia required the construction project to fulfil each of the noise emission levels regulations. Although the types of noise source that emit high levels and intrinsic characteristics may be varied from construction equipment, not all the noise

emission levels can be regulated (Ballesteros *et al.*, 2010). Therefore, awareness, training and control measures towards construction equipment might help in mitigating hazard of noise exposure.

1.2 Problem Statement

Occupational noise remains as a harm in all regions around the world. With the extreme exposure at the workplace, it leads to occupational injury (Nadya, 2010). Kerr *et al.* (2002) stated that noise was well-known hazard of construction work yet few studies have been carried out in the industry. Nevertheless, BS5228-1 (2009) stated protection to high levels of noise for unprotected ear can be a serious harm to health where it can cause permanent damage to hearing.

Based on National Industry Occupational Safety and Health (NIOSH, 2009), occupational noise injury or known as noise-induced hearing loss (NIHL) is the most common occupational injury. In addition, with the extreme exposure, it leads to sleep disturbance; annoyance, cognitive performance deterioration (Muzet, 2007). These injuries later deny the ability to converse normally with others and are endangered in the work environment (Lusk *et al.*, 2010). It is because noise exposure at the workplace is insufficient studied. Therefore, the focus on occupational noise exposure is important because it can risk accidents at the workplace. While the risk gives high potential to NIHL and other occupational hazards, therefore, the noise can be mitigated by limiting the exposure, and other controls measures to be taken. It is also essential to make studies on the construction equipments that may be responsible for the source for the noise exposure (Hattis, 2010).

Noise exposures have become apparent in few decades, mostly in the United States with growing concern about construction workers' hearing health. Studies

report found that noise exposure was common to all trades of works at the site with the mean of time weighted average (TWA) of 90.25 dBA however it exceeded the Occupational Safety, and Health Administration (OSHA) permissible exposure limit TWA of 90 dBA. Further report showed among 5 million construction workers; 754,000 workers were overexposed with noise levels of more than 85 dBA (Hattis, 2010).

In addition, studies also shown that workers work on heavy equipments (Neitzel *et al.*, 1999), building construction plants and ground work such as hammering, crane or heavy truck (Muzet, 2007) can be highly possible generate exposed to high level of noise emissions. Moreover, noise emission level between 80 dBA to 130 dBA for TWA level may cause workers overexposure to noise at the workplace. Besides that, Health and Safety Executive (HSE, 2005) recommended the standard limit noise exposure TWA should not exceed 80 dBA for lower action exposure, 85 dBA for upper action exposure and 87 dBA for protected exposure limit. Thus, construction's workers frequently have poor information and awareness about the risk of noise exposure and NIHL (Neitzel *et al.*, 1999). Studies shown that worker apathy, lack of self-regulation, meagre attentions to risk management, lack of trained personnel was some major shortcomings (Savage, 1999; Koushki *et al.*, 2004).

In spite of that, the Occupational Safety and Health Act (OSHA, 1994) in Malaysia stated that noise exposure had not been a major focus where there were only few fractions of observation and inspection. Where basic requirement for protection is against 85 dBA in TWA and 90 dBA for permissible limit exposures, most of the construction's projects did not comply the specific control measures that mandated for both the employers and workers working on the construction project. As well in the Factory and Machinery (Noise Exposure) Regulation 1989 (FMR, 1989) stated that all workers exposed to noise level exceeded 85 dBA should be protected for time exposure of eight hours TWA. While due to intrusive but temporal nature of construction noise, Annex A Schedule 6 DOE (DOE, 2007) stated that the

maximum permissible sound level of construction, maintenance and demolition works for planning guide as shown in Table 1.1:

Table 1.1: Maximum Permissible Sound Level of Construction, Maintenance and Demolition Works (Source: DOE, 2007)

Receiving Land Use	**Noise Parameter**	**Day Time 7.00 am-7.00 pm**	**Night Time 10.00 pm – 7.00 am**
Residential	L_{90}	60 dBA	55 dBA
	L_{10}	75 dBA	70 dBA
	L_{max}	90 dBA	85 dBA
Commercial	L_{90}	65 dBA	60 dBA
	L_{10}	75 dBA	70 dBA
Industrial	L_{90}	70 dBA	N/A
	L_{10}	80 dBA	N/A

Further evidence studies report that in Malaysia, construction activities are the second highest role in perspective of noise pollution (Haron *et al.*, 2008). While the noise is generated in different ways, it comes from varies sources such as the nature to the activities, surrounding environment, consideration of health and regulations and also the status of the construction equipment being used. In addition, a study stated that in the actual construction site, the noise generated from the source by the operation of the construction equipments differ in times, where due to the conditions occurs during the project off, idling, operate under light load or variations, which not only affect the distance between the source and observer but also alter the effects of screening, ground cover and other mitigating factors (Haron and Yahya, 2009).

Meanwhile, Haron *et al*. (2012) stated that the noise emission level of construction equipment is the key factor in determining the source of exposure. Normally, construction projects in Malaysia rely on current historical data of sound

level data on BS5228:2009 and also the DOE guideline as the brief guidelines. With this, the researcher determines to study and analyse the data between the guidelines and the actual site in Malaysian construction projects. In addition, studies of the need to control the exposure from sources also to be considered as a mitigation action. The awareness and control measures need to be taken seriously to prevent noise hazards.

1.3 Aims and Objectives of Study

The aim for the study is to assess the occupational noise exposure among construction workers and the compliance of permissible noise exposure to the construction industry. To achieve this aim, the study will be carried out based on the following objectives:

i. To obtain the noise exposure level among construction workers.

ii. To compare the compliance of permissible noise exposure level among construction workers.

iii. To assess the awareness and perceptions of noise exposure among workers.

iv. To explore the perceptions of noise impacts to safety and health workers.

1.4 Scope of Study

To ensure that the study to be conduct will achieve the aim and objectives, the study will focus on exposure among construction workers in superstructure phase buildings works where fewer reviews and previous studies were done on superstructure phase. In addition, three regulations were used for comparison of noise exposure which consists of FMR, OSHA and HSE. Moreover, the construction workers are those who work on the construction site with various trades.

1.5 Significant of Study

The significant to this study are:

i. This study can be a referral to both employers and workers of the importance to comply with the guidelines and need for control measures.

ii. This study also can be information to other builders towards awareness of construction noise, especially on occupational healths.

iii. This study too can be used as the basis for noise mitigation towards sustainable environment in construction sites.

1.6 Limitation

The limitations for this study are:

i. The researcher only focusing on the superstructure phase of construction works.

ii. The researcher did not focus on the surrounding community of the noise exposure.

iii. The researcher only focusing on sites, mainly in South of Johor Bahru areas where other sites may have variable data in certain circumstances such as the environment and other tasks of works.

1.7 Brief Methodology

This study was implemented in few stages where the first stage to the study focused on the on-site measurements and investigation on the compliance of noise exposure according to the respective regulations from various trades of workers. The on-site measurement was carried out with noise dosimeters that were placed on the shoulder of the workers which was approximately at the worker's hearing zone. In addition, questionnaires' survey was also distributed among workers at the respective construction site. Data obtained therefore were analysed in next stage using statistical analysis.

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